

NGST Ad Hoc Science Working Group
Meeting # 5, October 15,16
Space Telescope Science Institute

Summary Minutes & Updates

Attending: Bechtold, Beckwith, Burg, Fall, Gardner, Graham, Greene, Greenhouse, Heaton, Jakobsen, Kirshner, Lesyna, Liebert, Lilly, Long, MacKenty, Madau, Margon, Mather, Menzel, Meyer, Petro, Ressler, Rich, Rieke, Schneider, Serabyn, Smith, Stiavelli, Stockman, Thronson, Triebes

Members absent: Fosbury, Hall, Loeb, Moseley, Nicholson (at DPS), Onaka, Trauger (at DPS), van Dishoeck

Thursday, Oct. 15 Boardroom.

(Editorial note. These minutes reflect my notes and fairly confident memory. The meeting did not follow the preliminary agenda as distributed in the second data pack and essentially eliminated the items on science policies and DRM update in favor of devoting more time to the theme review and priority voting. I also indicate strong ASWG concerns with *** and updates as of Jan. 1 with ---)

The meeting opened with a welcome from Steve Beckwith, new STScI Director. Beckwith encouraged the ASWG to consider the "discovery space" for NGST as much as the detailed DRM goals.

John Mather presented the Project status for Bernie Seery. The overall budget for the NGST project looks good, permitting the Project to move into the formulation phase (Phase A). The second Standing Review Board meeting was a success, with NASA, Ball, and TRW presenting the results of the Pre-Phase A studies. NASA has reached agreement with DoD on technology funding of lightweight optics and possible collaboration on NEXUS (Pathfinder 3). NEXUS remains undefined at this time.

*** The ASWG requested that its advice be requested before plans for NEXUS become too concrete. ***

--- the NESR expressed similar concerns about relying on the DoD for

technology but were assured that all NGST technology would be unclassified ---

Peter Jakobsen reviewed the status of the ESA/NASA collaborations. Huntress and Bonnet have signed letters of intent. The science case will be presented to the SPC. If they approve, the remaining steps should be smooth (budgets permitting). Peter also reviewed the makeup of 3 studies (~3M\$) that ESA is funding: a study led by LeFevre on NIR spectrographs (MOS and IFS); a telescope and payload suite study including MIR instruments (same large consortium), and a visible camera/spectrograph study with responses due on 27 November.

Harley Thronson presented the view from NASA-HQ.

- . AXAF launch delay: nearterm budget problem
- . Unprecedented number of congressional earmarks: ditto on budget impact, ~ 20M.
- . 100K should be available for continuing ASWG studies (much gnashing of teeth over this.)
- . Charting a half dozen ad hoc future mission working groups: missions starting development in 2010 or later (post NGST, SIRTf, TPF, Constellation-X). The UV-Visible team is led by Mike Shull and the IR-Submm is led by George Rieke.
*** Few or none of the ASWG were aware of these studies and requested to be informed of future opportunities.***

. On November 1, Weiler (acting AA) will review the results of the SRB and various project plans as well as the recommendations of the ASWG to approve the plans for procuring Phase A/B and B/C/D contractors (moving into Phase A). This meeting will establish the high level scientific capabilities of the NGST for the purposes of the Phase A studies.

Matt Greenhouse presented the ISIM Procurement Plan. The main elements were:

- . GSFC would have the overall system engineering and management role for developing the ISIM infrastructure and interface requirements.

. In summer 1999, an external review board, the Joint Science Review Board (JSRB) would prioritize the various instrument concepts on the basis of overall scientific promise and readiness. These recommendations would be the basis for NASA/ESA/CSA agreements regarding international contributions. This prioritization would also permit more focused funding of technology development for the ISIM.
. There are many benefits to using common detector technologies in the ISIM and a mass-buy by NASA in 1999 (making the detectors government furnished equipment (GFE)).

*** The ASWG expressed concern about being left out of the JSRB process and committing to a detector technology so long before launch. ***

--- Later discussions with Weiler and Campbell have led to a revised plan in which the ASWG is the primary advisory body on this topic: advising the NGST Project Scientist and hence HQ. Detectors development will continue on several fronts until the selection of the ISIM instruments. Mass buys are still possible after the selection based upon the recommendation of the ISIM IPT which includes the ISIM PIs. ---

Jill Bechtold, James Graham, and Gene Serabyn presented updates on their ISIM studies. Of particular note were the Arizona team's different telescope architecture allowing for an enormous focal plane field of view, 21 arcminute diameter. The Arizona team believes that both NIR and visible detectors will be sufficiently inexpensive to tile several 6' x 7' FOV formats. James Graham mentioned that CSA has funded a Canadian group to collaborate on the Fourier Transform Imager (<http://astron.berkeley.edu/~jrg>). He showed simulations of data cubes revealing a $z \sim 3$ SNe and a $Z \sim 12$ protogalaxy in terms of their low-moderate resolution spectra!

Pierre Bely discussed the results of two studies. The first was on the cost of passive cooling versus a temperature controlled primary running at ~ 100 K. The advantage of the latter architecture is that the mirror optics and OTA can be tested in chambers cooled by LN₂ versus LHe. Using input from aerospace contractors on the cost of upgrading various chambers, the study concludes that the original

"Yardstick" concept of passive cooling to $\sim 30\text{-}50\text{K}$ is not significantly more expensive than a superbly controlled warmed primary and is less risky (requires less modeling and testing to guarantee adequate temperature control and can cool NIR detectors without an active cooler.) It also is "compatible" with MIR instruments since the scattered light from the warmer sunshield is less than the zodiacal background at wavelengths less than 12 microns. Marcia Rieke and Simon Lilly point out that the sensitivity at 28 microns is still superior to SIRTf and capable of detecting milli-Arp 220s at $z \sim 2\text{-}3$.

Pierre also showed estimated costs for adding an optical channel. These were substantial, partly because the addition of a visible imager appears to require active cooling to offset the heating of the CCDs.

*** Several ASWG members questioned these numbers, since they were rough order of magnitude numbers. ***

--- Weiler accepted the Bely-led study and set the Phase A goals of NGST being zodiacal light limited from 0.6 – 10 microns (the MIR-compatible architecture). Based upon data from Raytheon (SBRC), it appears that InSb can be coated to work well at visible wavelengths with little impact in the NIR. Weiler insists that the cameras Nyquist sample the images at the diffraction-limit wavelength, 1-2 microns. ---

Mid-afternoon Thursday – mid-Morning Friday

This period was devoted to presentations by the 5 theme leads of their science goals and needs for the observatory beyond the NIR core capabilities. The presenters and recommendations were:

Schneider- Cosmology

- 1) Huge FOV
- 2) Visible imaging for color redshifts

Lilly – Origins and Evolution of Galaxies

- 1) Visible imaging for color redshifts
- 2) NIR-NMIR spectrographic resolution ~ 3000 .
- 3) MIR imaging to 20-30 microns for dust enshrouded star formation.

Rich – History Milky Way and Neighbors

- 1) Extension of visible imaging to V band to discriminate

color changes versus age/metallicity.

2) Good, well sampled PSF (diffraction-limit at ~ 1 micron probably ok)

Meyer- Star Formation

1) MIR imaging and spectroscopy 5-30 microns

2) High resolution spectroscopy, 4.5-18 microns $R \sim 30,000$.

3) Coronagraph imaging (NIR and MIR)

4) Extension to visible wavelengths

Nicholson via Rieke KBOs, Planets and Debris Disks

1) MIR for KBO and debris disk thermal emission

2) Coronagraph to detect reflected light from debris disks and possibly direct planet detection if optics are sufficiently smooth and clean.

Nicholson reports from the DPS meeting that members requested ability to track solar system objects as close as asteroid belt and certainly near Jupiter. Other requests were for a large viewing zone ($>$ half sky at one time), high resolution spectroscopy ($R \sim 10,000$) in NIR and MIR and NIR, MIR filters that match molecular absorption bands (e.g. methane).

Scientific Priorities: At the request of Harley Thronson, the ASWG voted on the priorities for scientific capabilities for NGST. The votes were to reflect not only the needs of the DRM observations but also the perceived "discovery space" value as estimated by each ASWG member. Details of instruments (such as low-high resolution spectroscopy) and smaller/larger apertures were not considered in this vote. Eric Smith tallied the vote in a variety of categories.

NIR Camera: 25%

NIR Spectrograph: 24%

Visible Camera: 14%

Visible Spectrograph: 1%

Improved Optics: 5%

MIR Camera: 18%

MIR Spectrograph: 12%

Coronagraph: 2%

The average standard deviation of the mean was ~ 2% but the SD of each category varied from 3%-13% indicating widely differing votes. Remarkably, these priorities roughly match the percentage use of science instruments in the DRM.

--- These results were reported to Weiler on Nov. 1 and supported the decision to move into Phase A with a MIR-compatible architecture.---

Finally, the ASWG recommended that the Theme leads have a dry-run on November 16 for the NGST External Science Review (to be held on Dec. 1-2)

--- The Theme leads (with some substitutions) and Stockman met for six hours in the Denver airport on Nov. 16. As a result, the NESR presentations were considerably improved over those of Oct. 16. I will report the reactions of the NESR to the DRM and the five themes in a future email. ---